


# Nutrition in Diabetes and Cardiovascular Disease

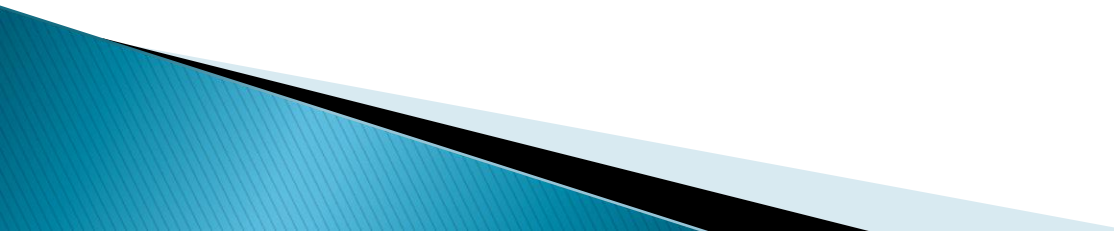
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# Nutrition in Diabetes & Cardiovascular Disease(CVD)

## ► Objectives:

1. Define the role of Diabetes(DM) in development of Cardiovascular disease(CVD)
  2. Evaluate prevalence/risks for DM in CVD
  3. Discuss the role of modifiable and non-modifiable risk factors in contributing to DM and CVD
  4. Discuss Medical Nutrition Therapy (MNT) and the role of Bioactive Food Components in risk reduction strategies
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# What is the relationship between Diabetes and CVD?

- ▶ Cardiovascular disease encompasses the chronic macrovascular complications of DM to include: coronary artery disease, peripheral vascular disease, myocardial infarction, and cerebrovascular disease.
  - ▶ The pathophysiology of CVD in DM is multifactorial. Evidence is suggestive that diabetes may impact vascular function both thru hyperglycemia and insulin resistance. Effects appear to be greater when both are present vs. singularly
  - ▶ CVD is the most common cause of morbidity and mortality in DM
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# Risks/ Prevalence of Cardiovascular Disease in DM



# Cardiovascular Disease Risks and Prevalence in Diabetes

- ▶ Persons with Diabetes are 2 to 3 times more likely to develop CVD than persons without diabetes
- ▶ Individuals with Type I have a five fold increase risk for cardiovascular events between ages 20 to 30
- ▶ Preliminary data show young people with Type 2 DM or those with the components of the metabolic syndrome are at increased risk of CVD

Miller M, et al. Practical Diabetology. 2004;23(2):213-18

The Art and Science of Diabetes Self Management, 2006



# Cardiovascular Disease Risks & Prevalence in Diabetes

- ▶ In 2003, one study showed that 38% of individuals with Diabetes age 35 and older reported receiving a diagnosis of CVD
- ▶ CVD & its' effect may be present for many years prior to diagnosis particularly in Type 2 diabetes
- ▶ DX of DM is a risk equivalent of coronary heart disease(CHD)

# Cohort Studies Supporting Risks of CVD in DM

- ▶ One Finnish Study showed that 1yr mortality rate following an MI was higher in men & women with diabetes when compared with those without DM)
- ▶ The Multiple Risk Factor Intervention Trial(MRFIT) found that systolic hypertension, elevated cholesterol levels and cigarette smoking independently predicted cardiovascular mortality and that the presence of any one risk factor affected outcomes more in persons with diabetes than those without

Haffner, SM. Diabetes Care.1998;21:160-78.

Stamler, J, et al. Diabetes Care.1993;16:434-44.



# Life Style Interventions

»» Modifying Risk Factors



# CVD Risk Factors

## ▶ Non-Modifiable Risks:

- Duration of diabetes
- Age
- Gender
- Sex
- Genetics

## ▶ Modifiable Risks

- Obesity
- Physical inactivity
- Hypertension
- Smoking
- Glycemic Control
- Dyslipidemia
- Nutrition/Eating Habits

# Non-Modifiable Risk Factors

- ▶ Appears to be a Linear relationship between duration of diabetes and CVD and possibly Age.
- ▶ No specific predictive factors for Genetics and Ethnicity
  - African American have higher rates of CVD than caucasians
  - Mexican American have higher risk of peripheral vascular disease
- ▶ Gender protective factor for premenpausal females without diabetes. No gender protection for females with diabetes. Risk for CVD is equal to males with diabetes.

# Life style Interventions to Reduce Risk of CVD & DM

- ▶ The DPP confirms that lifestyle modifications were nearly twice as effective as medication in preventing DM—58% vs.38%
- ▶ Lifestyle intervention should focus on reducing modifiable risk factors associated with CVD
- ▶ Medical Nutrition Therapy (MNT) is integral to the prevention and treatment of CVD in diabetes and should focus on :
  - Reducing
    - saturated fat, trans fat and cholesterol
    - weight
  - Increasing
    - Dietary fiber & plant stanols/sterols,
    - activity
    - Omega 3 fatty acids

# Goals of MNT in Diabetes

- ▶ Prevent and treat the chronic complications of diabetes
  - Attain and maintain
    - blood glucose and A1c level
    - LDL-C , HDL-C & TG levels
    - Blood pressure
    - Body weight
- ▶ Improve health through healthy food choices and physical activity
- ▶ Address individual needs
  - Account for personal & cultural preferences and respecting individuals willingness to change
- ▶ For individuals treated with medication provide self management education to treat/prevent hypoglycemia, acute illness and exercise related BG problems

ADA:Standards of medical Care in diabetes-2006. Diabetes Care.2006;29 suppl 1:s4-42.

# Modifying Risk Factors thru Lifestyle Interventions

- ▶ Obesity(BMI >20% above IBW)
  - Strongly associated with insulin resistance which may lead to CVD. Central abdominal obesity pose greatest risk for CVD. Weight loss can improve CVD, increase insulin concentration and insulin sensitivity.

# Physical Inactivity a Modifiable Risk

## ► Physical Inactivity

- Limited studies on diabetes and CVD but early data suggest benefits with or without DM.
- Increasing Physical Activity can:
  - Aid in weight loss (modest loss of 5 to 10% of body weight)
  - Prevent or delay onset of Type 2
  - Decrease blood pressure and risk for heart attack and stroke
  - Decrease total cholesterol, TG, & LDL-C
  - Increase HDL-C

# Physical Activity a Modifiable Risk

## ► Prospective Study

- 1700 patients with Type 2 DM
- Found moderate to high levels of exercise decreased total and cardiovascular mortality independent of risk factors such as smoking high blood pressure, high BMI and elevated cholesterol

HU, G, et.al. Diabetes Care. 2005;28:799–805.



# Hypertension A Modifiable Risk Factor

- ▶ Hypertension ( $<130/80$ )\*<sub>ADA & JNC</sub>
  - Hypertension and DM doubles risk for CVD.
  - Abdominal obesity consistently correlates with increased blood pressure independent of other risk factors
  - Joint National Committee (JNC 7) found that for every 10kg of wt loss = 5 to 10mmHG drop in the systolic BP
  - Positive association with insulin resistance
    - UKPDS study found modest BP reduction in persons with DM and HTN reduces mortality esp. strokes

Chobanian AV, et al JAMA. 2004;289:747-52.



# Hypertension Management Goals

- ▶ Weight loss
- ▶ DASH eating plan
- ▶ Decrease Na
- ▶ Moderate alcohol intake
  - < 1 to 2 drinks/day appears to have no adverse effects on BP
  - One study showed that Chronic intake—3 or more drinks/day increases BP in both men and women
- ▶ Increase physical activity
  - According to American Heart Assoc statistics, those less active have 30 to 50% greater risk for high BP
  - One Study showed regular aerobic activity decreased BP in hypertensive and non-hypertensive persons independent of weight loss.

# What is the DASH Eating Plan?

## ▶ DASH–Dietary Approaches to Stop Hypertension

- Promotes a diet high in fruit & vegetables, low fat dairy foods and decreased total fat and cholesterol
- Significant reduction in BP even in absence of weight loss and at current Na intake typical of US diet

- | ▶ Food group         | Servings  |
|----------------------|-----------|
| ◦ Grains             | 7–8 daily |
| ◦ Vegetable          | 4–5 daily |
| ◦ Dairy              | 2–3 daily |
| ◦ Meat/fish/poultry  | ~2 daily  |
| ◦ Nuts/seeds/legumes | 4–5/wk    |
| ◦ Fats & oils        | 2–3 daily |
| ◦ Sweets             | 5/wk      |
- 
- | ▶ Portions Size             |
|-----------------------------|
| ◦ ½ c rice or pasta         |
| ◦ 1 slice bread             |
| ◦ 1 cup raw veg or fruit    |
| ◦ ½ cup cooked veg or fruit |
| ◦ 8 oz milk                 |
| ◦ 1 tsp olive oil           |
| ◦ 3oz cooked meat or tofu   |

Internet:

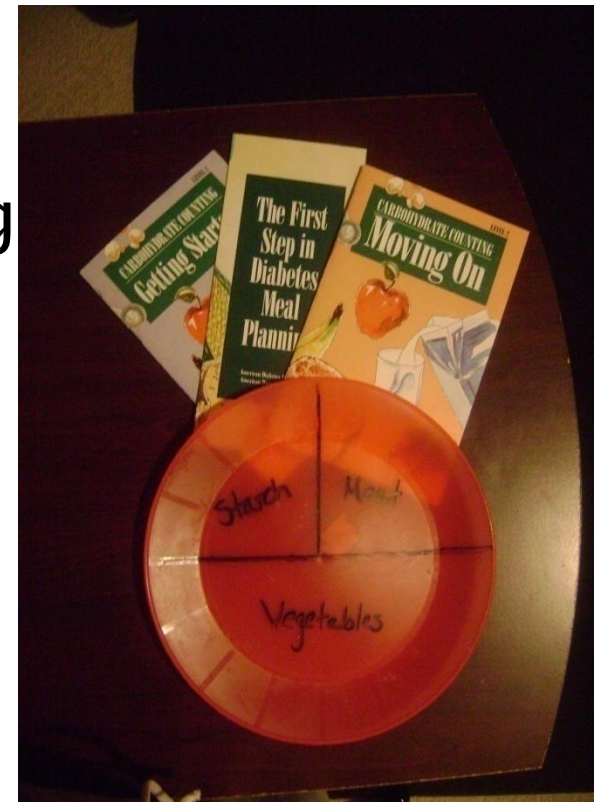
[www.nhlb.nih.gov/prevent/h\\_eating/h\\_e\\_dash.htm](http://www.nhlb.nih.gov/prevent/h_eating/h_e_dash.htm)

2400 mg of salt/day=1 teaspoon

Diet decreased BP by 8 to 14 mmHG

# Additional Meal planning Resources

- ▶ Healthy Food choices
- ▶ Dietary Guidelines for Americans
- ▶ My Pyramid
- ▶ The Plate method
- ▶ Exchange list for meal planning
- ▶ CHO counting



# Modifiable Risk Factors (cont)

## ▶ Smoking

- According to CDC, 20% deaths directly linked to smoking
- Risk of coronary death can be ↓ by 50% the 1<sup>st</sup> year with smoking cessation

## ▶ Glycemic Control

- The risk of CVD secondary to hyperglycemia is not totally clear but again is believed to be related to insulin resistance or the metabolic syndrome
- UKPDS study found that people in the upper tertile of A1cs' had a 50% increased cardiovascular risk
- The EPIC Norfolk study found men with diabetes had increase risk for cardiovascular morbidity and mortality but also found in those without diabetes for every 1% increase in A1c = 28% > risk for a cardiovascular event
- Turner RC, et al. BMJ. 1998;316:823–8.
- Khaw KT, et al. BMJ. 2001;322:1–6

# Dyslipidemia –A Modifiable Risk Factor

## ► Types of Fats

- Saturated (animal origin)
- Unsaturated (plant origin)
  - Monounsaturated
  - polyunsaturated
- Lipid abnormalities present in >95% of persons with Type 2 diabetes
  - Common Pattern--Combination of high triglycerides (TG) and low HDL-C (high density lipoprotein)
  - Achieving LDL-C (low density lipoprotein) goals can reduce risk of CVD

# Dyslipidemia Goals

## Goals:

- ▶ Reduce saturated fat to <7% of calories,
- ▶ Reduce dietary cholesterol to <200mg per day
- ▶ Minimize consumption of foods with trans fat
  - ▶ Saturated fats and trans fats have the greatest impact on LDL-C
  - ▶ Studies support replacing saturated fat with unsaturated fat or carbohydrate, lowers LDL-C
- LDL-C <100mg/dL
- TG <150mg/dL
- HDL-C
  - Men >40mg/dL
  - Women >50mg/dL
- ▶ ADA recommends screening annually in most adults with DM. If LDL-C <100mg and HDL-C > 50, check lipids every 2 years

# Dyslipidemia (cont)

- ▶ Omega 3 fatty acids have been shown to reduce the incidence of CVD
  - Will not decrease TG
- ▶ Omega 3 Fatty Acids–Plant Sources( $\alpha$  Linolenic Acid:
  - Canola, soybean, flaxseed & English walnuts
- ▶ Omega 3 Fatty Acids–Marine Sources:
  - ▶ Fish oil capsules or liquid
    - 2–4grams/day of eicosapentanoic acid (EPA) and docosahexanoic acid (DHA) is needed to decrease TG by 20 to 30% & to increase HDL–C up to 5%.
  - ▶ Fatty fish
    - –salmon, herring & mackerel
    - AHA recommends 2 or more servings of fish/week for non–diabetics. More servings suggested in diabetes

Kris–Etherton PM, et al. Circulation.  
2002;106:2747–57.

# MNT and the Role of Fiber in CVD & DM Management

## ▶ Insoluble Fiber

- Can not dissolve in water
- Effective in adding bulk and increasing the rate of passage of food through the intestinal tract
- Food Sources:
  - Wheat bran, brown rice, whole wheat bread, cereals, spinach, almonds, berries

## ▶ Soluble Fiber

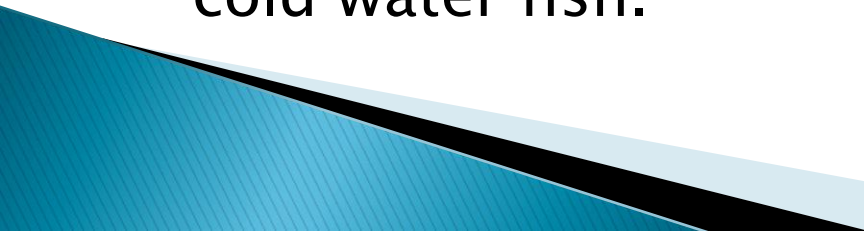
- Can dissolve in or absorb water
- Effective in binding toxins and cholesterol in the intestinal track
- Food sources:
  - Oatmeal, oat bran, apples, pears, psyllium, barley, legumes



# MNT & Bioactive Food Components

» Risk reduction Strategies

# What are Bioactive Food Components

- ▶ Term refers to nonessential bio-molecules found in foods that regulate one or more metabolic processes resulting in better health
    - ? Exact mechanism not fully understood how health promoting benefits are imparted but it appears they do act at different or identical target sites
  - ▶ Predominately found in plant foods such as whole grains, fruits and vegetables
  - ▶ Probiotics, linolenic acid, & long chain omega 3 polyunsaturated fatty acids are sources found in animal products such as milk, fermented milk and cold water fish.
- 

# MNT & Bioactive Food Components

- ▶ Benefits of Bioactive foods are the potential to decrease risk of : cancer, CVD, osteoporosis, inflammation, Type 2 diabetes, & other chronic degenerative diseases

# MNT & Bioactive Food Components

## Role in CVD prevention

- ▶ Stanols/sterols esters (phytosterols)
  - Inhibits dietary & hepatic cholesterol absorption in the intestinal tract
  - Found naturally in small amounts in fruits, vegetables, nuts, seeds, cereal, legumes and vegetable oil
  - Found in Fortified Food products
    - Added to oil based margarine, spreads, orange juice, cheese and yogurt (EX. Benecol)
    - 2 grams per day have been shown to reduce LDL-C and total cholesterol.
    - 2 to 4 servings of stanol rich foods is needed per day to provide the recommended 2 grams/day

Lichtenstein AH, et al. Circulation, 2001:103-117

# Fortified Food Products





# Fortified Food Products

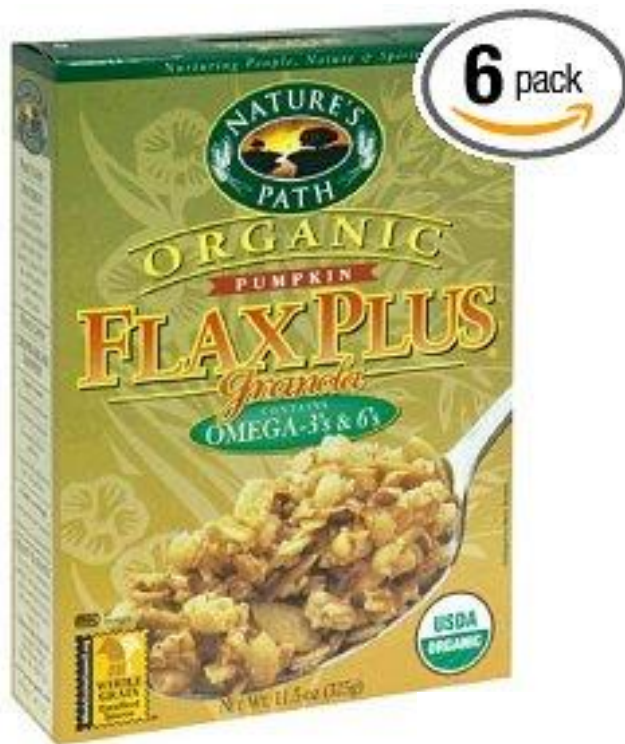


# Fortified Food Products





# Fortified Food Products





# MNT & Bioactive Food Components

## Role in CVD

- ▶ One study reported in Food Technology indicated that consuming 2 grams/day of stanols could slash risk of heart disease by 25 %
- ▶ Another study published in the American Journal of Clinical Nutrition revealed that phytosterols interfered with cholesterol absorption by 33% to 42 %.
- ▶ The FDA has approved the following claim for phytosterols: 0.4 grams/serving twice a day with meals for a total intake of at least 0.8 grams as part of a diet low in saturated fat and cholesterol may reduce risk of heart disease.

# MNT & Bioactive Food Components in CVD

## ▶ Isoflavone

- May decrease circulating oxidized LDL in the plasma
- May bind cholesterol in the intestinal tract to decrease absorption of dietary cholesterol, increase bile excretion leading to decrease endogenous cholesterol levels
- Modulate arterial elasticity improving blood vessel dilation and constriction response

# MNT & Bioactive Food Components

## ▶ Vitamin E & Antioxidants

- Oxidative stress is associated with endothelial dysfunction
- Antioxidant therapy is suggested as a cardiovascular risk reduction strategy particularly use of vitamin E
  - As reported in The Art and Science of Diabetes Self Management 2006,
    - The SEARCH Study combined vitamin E and Zocar(simvastatin) showed increased risk of cardiovascular events
    - HOPE & HOPE TOO studies found that Vitamin E supplementation in diabetes or CVD did not reduce rate of major cardiovascular events and may increase risk of heart failure

# MNT & Bioactive Food Therapy

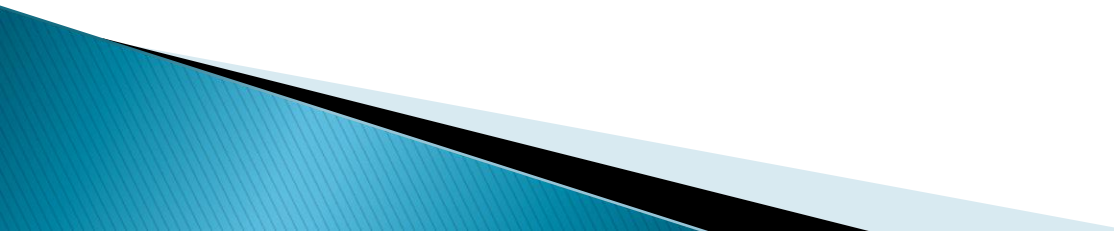
- ▶ Folic acid & Vitamin B6
  - Increase levels of homocysteine linked to increased cardiovascular risk
  - Supplementation with Folic acid and B6 lowers homocysteine
  - NORVIT study did not support over all improvements but found if folic acid is supplemented in conjunction with pyridoxine , increase risk of MI by 21%

Graham, IM, NORVIT. Available on the Internet at [www.escardio.org/knowledge](http://www.escardio.org/knowledge), Sept 2005

# Dietary Supplements

» Alternative Medicine for  
Diabetes

# Popular Dietary Supplements For Diabetes

- ▶ Cinnamon
  - ▶ Gymnema sylvestre
  - ▶ Fenugreek
  - ▶ Bitter melon
  - ▶ Ginseng
  - ▶ Nopal
  - ▶ Chromium
  - ▶ Aloe vera
  - ▶ Garlic
- 

# Dietary Supplements

- ▶ Defined as a product taken by mouth that contains dietary ingredient intended to supplement the diet.
- ▶ May include vitamins, minerals, herbs, etc..
- ▶ Can come in different forms—liquids, extracts, tablets, powders
- ▶ Hypoglycemic Agents
  - Bitter melon, Fenugreek, Gymnema
- ▶ Carbohydrate Absorption Inhibitors
  - Fenugreek, psyllium, oat bran, prickly pear
- ▶ Insulin Sensitizers
  - Cinnamon, chromium, ginseng

## Popular Supplements for Diabetes

Product	Use	Mechanism of Action	Side Effects & Drug Interactions
Cinnamon	GI Flavoring	↑ Insulin sensitivity, ↑ cell/tissue glucose uptake	Skin irritation. May decrease BG if used with secretagogues
Gymnema	“sugar destroyer”	↑ enzyme activity for glucose uptake may ↑ beta cells number ↑ insulin release	May cause hypoglycemia No drug interactions reported



## Popular Supplements for Diabetes

Product	Use	Mechanism of Action	Side Effects
Fenugreek	<ul style="list-style-type: none"> <li>•Diabetes</li> <li>•Hyperlipidemia</li> <li>• Flavoring</li> <li>•Constipation</li> <li>• Enhance milk secretion</li> </ul>	<ul style="list-style-type: none"> <li>• Delay gastric emptying</li> <li>•↑ insulin receptors</li> <li>•Slow CHO absorption</li> <li>•Inhibition of glucose transport</li> </ul>	<ul style="list-style-type: none"> <li>•GI upset</li> <li>•Uterine contractions</li> <li>•Allergic reactions</li> <li>•May ↑ anticoagulant effects</li> </ul>
Bitter Melon	<ul style="list-style-type: none"> <li>•Diabetes</li> </ul>	<ul style="list-style-type: none"> <li>•↑ glucose uptake by tissues</li> <li>•Inhibit enzymes involved in glucose production</li> <li>•Enhance glucose oxidation</li> </ul>	<ul style="list-style-type: none"> <li>•GI upset</li> <li>•Spontaneous miscarriage</li> <li>•Hypoglycemia coma</li> <li>•Hypoglycemia when combined with sulfonylureas</li> </ul>

## Popular Supplements in Diabetes

Product	Use	Action	Side Effects
Ginseng	<ul style="list-style-type: none"><li>• Enhance immune system</li><li>• sport performance enhancers</li></ul>	<ul style="list-style-type: none"><li>• ↓ rate of CHO absorption</li><li>• ↑ glucose transport and uptake</li><li>• Modulates insulin secretion</li></ul>	<ul style="list-style-type: none"><li>• Insomnia, restlessness, nervousness</li><li>• ↑ BP or heart rate</li><li>• Headache</li><li>• Estrogenic effects</li><li>• ↓ warfarin, diuretics &amp; HTN meds</li></ul>
Nopal	<ul style="list-style-type: none"><li>• Used to lower blood glucose</li><li>• Hyperlipidemia</li><li>• Hangover</li></ul>	<ul style="list-style-type: none"><li>• Slow CHO absorption</li><li>• ↓ lipid absorption</li><li>• Possibly ↑ insulin sensitivity</li></ul>	<ul style="list-style-type: none"><li>• Diarrhea, nausea, abdominal fullness</li></ul>

## Popular Supplements in Diabetes

Product	Use	Action	Side Effects
Aloe	<ul style="list-style-type: none"><li>•Laxatives</li><li>•Gel used for wounds, diabetes &amp; hyperlipidemia</li></ul>	<ul style="list-style-type: none"><li>•Fiber may promote glucose uptake</li></ul>	None reported
Chromium	<ul style="list-style-type: none"><li>•Glycemic control</li><li>•Hyperlipidemia</li><li>•weight loss</li><li>•Performance endurance by athletes</li></ul>	<ul style="list-style-type: none"><li>•↑ insulin receptor</li><li>•↑ insulin sensitivity</li></ul>	<ul style="list-style-type: none"><li>•Renal toxicity</li><li>•Dermatological eruptions</li><li>•Hypo with secretagogues or chromium</li><li>•Vit c &amp; NSAIDs may ↑ urinary chromium excretion</li></ul>

## Popular Supplements for Diabetes

Product	Use	Action	Side Effects
Alpa Lipoic Acid	<ul style="list-style-type: none"><li>•coenzyme</li></ul>	<ul style="list-style-type: none"><li>•May ↓ oxidative stress caused by hyperglycemia</li><li>•May help with peripheral neuropathy</li></ul>	<ul style="list-style-type: none"><li>•GI upset</li><li>•Possible skin allergies</li></ul>
<ul style="list-style-type: none"><li>•Garlic</li></ul>	<ul style="list-style-type: none"><li>•Lower BP</li><li>•↓hyperlipidemia</li></ul>	<ul style="list-style-type: none"><li>•antioxidant</li></ul>	<ul style="list-style-type: none"><li>•↑ GI upset</li><li>•Bleeding reactions</li></ul>

# Conclusions:

- ▶ Healthy eating impact DM and CVD thru weight, blood pressure & dyslipidemia improvements. Combinations of multiple risk factors can contribute to the development of CVD in DM. Some risk are modifiable and some are not. MNT is integral to the prevention and treatment of CVD & DM and should be part of the care plan for every individual with diabetes. Results from the DPP confirms that Life style modifications were nearly twice as effective as medication in preventing DM.
- ▶ Life style modifications should:
  - promote weight loss
  - increase physical activity
  - achieve lipid & BP goals
  - promote glycemic control

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